

Relationship of CD4++ Count with Viral Load in HIV/AIDS Patients

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ABSTRACT

Background and Objective: CD4+ cell counts and viral loads are the parameters which are used to monitor the health status in individuals infected with Human Immunodeficiency Virus (HIV). Viral load affects CD4+ counts, as high levels of virus in blood causes reduction in CD4+ counts leading to symptomatic disease in future. This study was aimed to determine the relationship between CD4+ cell count and viral load in HIV patients.

Methods: One hundred six (106) HIV positive patients presenting at the Pathology laboratory of Allama Iqbal Medical College, Lahore, Pakistan were enrolled for the study. CD4+ counts and viral loads were measured. Association between two parameters was calculated by applying statistical tests. A P value of less than or equal to 0.05 was considered as statistically significant.

Results: Of the total 106 patients, there were 83 (78.3%) male 17 (16%) female patients and 6 (5.7%) transgenders. Majority of the study population 50/106 (47.2%) had CD4+ lymphocyte count $\geq 500/\mu\text{l}$, 38/106 (35.8%) cases had CD4+ lymphocyte count in the range of 200 – 499/ μl , while CD4+ lymphocyte count $< 200/\mu\text{l}$ was seen in 18/106 (17%) cases. Reciprocal relationship was observed between CD4+ count and viral loads. Statistically significant difference was observed ($P = 0.012$).

Conclusion: CD4+ cell count and viral load are utilized as predictors of progression and severity of HIV infection.

KEYWORDS: *Human Immunodeficiency Virus, CD4+ cell count, Viral load.*

INTRODUCTION

The human immunodeficiency virus (HIV) is one of the family of retrovirus that infects, destroys and paralyzes the immune system of human body. As the infection advances the immune system is unable to resist the infections. It can take years to develop full blown disease called Acquired Immune-deficiency Syndrome (AIDS).¹

HIV causes the destruction of CD4+ helper T lymphocytes both in peripheral blood and lymphoid tissues.² Estimation of CD4+ count is an essential parameter for staging and monitoring the disease progression.³ CD4+ count assesses the severity of immune dysfunction. CD4+ T lymphocyte count is the number of CD4+ T cell per micro-liter of blood. It assesses the risk of opportunistic infections, prognosis and guides the physician when to start the antiretroviral drugs.⁴

After seroconversion, plasma HIV-RNA is a stronger predictor of immune destruction and disease progression. This measure is independent of CD4+ counts.⁵

Viral load shows the number of copies of HIV RNA per milliliter of plasma. HIV lives within cells. HIV plasma levels reflect the burden of infection and viral replication magnitude. It is used to assess the risk of

disease progression, provide guidance for initiation of treatment and monitoring response to antiretroviral therapy (ART).⁶ Detection limits of the viral load assays are 50 – 750,000 copies/ml.⁷

HIV/AIDS pandemic is a major public health problem and recently emerged as an epidemic in Pakistan. It is not only a medical problem but social stigma as well. The basic data about HIV/AIDS is still not available. This issue needs special consideration with reference to diagnosis, treatment and monitoring of the disease.

This study determines the CD4+ count & viral loads in HIV/AIDS cases.

METHODS

It was a cross sectional study carried out at the Department of Pathology, Allama Iqbal Medical College, Lahore, Pakistan after approval from Ethical Committee of the institute. A total of 106 diagnosed subjects of HIV infection with all genders and age range of 18-65 years were enrolled through non-probability/purposive sampling in the current study.

HIV positive subjects diagnosed for first time by ELISA and confirmed by Western Blot were referred from Punjab AIDS Control Programme, Lahore.

HIV Positive subjects with documented evidence of any other immunological disorder that lower CD4+ counts and /or patients already on antiretroviral therapy (ART) were excluded from the study.

Immunological categorization of cases was done as per Centre for Disease Control (CDC) classification system.

- CD4++ T lymphocyte count $\geq 500/\mu\text{l}$.
- CD4++ T lymphocyte count 200 – 499/ μl .
- CD4++ T lymphocyte count $< 200/\mu\text{l}$.

Five ml of venous blood samples were taken from every patient in EDTA vacutainer tubes between 09:00 am and 12:00 am and analyzed within 06 hours. CD4+ lymphocyte count was evaluated on BD FACS Calibur, “an automated four color” flow cytometer which performs both cell sorting and analysis. The counts were determined by a monoclonal antibody cocktail comprising of CD3+ Per Cp, CD4+ FITC and CD8+ PE in a Tru Count tube.

Plasma viral loads were detected and quantified by fluorescence real time PCR using Rotor Gen Q series with Qiagen kits.

STATISTICAL ANALYSIS

Data was analysed in software SPSS 23. Frequencies, percentages, mean and SD (standard deviation) were calculated. Cross tabulations were carried out. Comparison of CD4+ counts with another variable was done. ANOVA test was applied to compare the means. P value (≤ 0.05) was labelled as significant.

RESULTS

One hundred & six cases with HIV/AIDS were enrolled in this study, fulfilling inclusion and exclusion criteria. Mean age of subjects included in the study was 31.4 ± 8.5 with the range of 18 and 65 years. Frequency and percentages of different age groups and marital status is given in Table-1. Out of 106 subjects, there were 83 (78.3%) males, 17 (16%) female patients and 6 (5.7%) trans-gender (Fig. 1).

Mean CD4+ count and viral load were 481 ± 299 and 3799157 ± 24553168 , respectively. The overall minimum and the maximum CD4+ T cell counts were 10 to 1528 cells/ μl (Table-2).

The patients were grouped based on Centre for Disease

Table-1: Demographic features of HIV/AIDS subjects.

Feature	Groups	Frequency	Percent
Age (Years)	< 30	58	54.7
	30-39	32	30.2
	40-49	10	9.4
	≥ 50	6	5.7
Marital Status	Married	65	61.3
	Single	41	38.7
Mean age = 31.4		SD = 8.55	Minimum = 18
			Maximum = 65

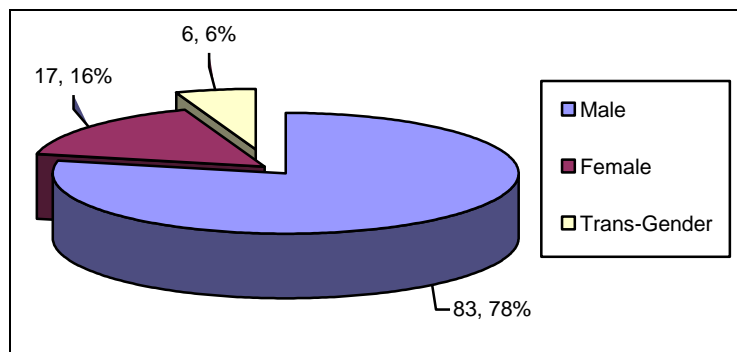


Fig. 1: Gender Distribution of Subjects.

Table-2: Distribution of CD4+ count and Viral Load in HIV/AIDS Cases (n = 106).

Parameter	Mean	SD	Minimum	Maximum
CD4+ Count Per μl	481	299	10.0	1528
Viral Load (Copies/ml)	3799157	24553168	0	252149310

Table-3: Distribution of CD4+ counts (Immune Suppression) according to CDC Classification.

CD4+ count (Immune Suppression)	Frequency	Percent
< 200/ μl	18	17.0
200-499/ μl	38	35.8
$\geq 500/\mu\text{l}$	50	47.2
Total	106	100.0

Control (CDC) classification as given in Table-3.

This study compared viral load with various groups of CD4+ T cell levels. A significant difference was found between the categories as determined by one-way ANOVA ($P=0.012$). A reciprocal relationship was observed between viral load and CD4+T cell count. (Table-4 and Fig. 2).

The mean \pm SD viral loads were 19286695 ± 58395959 , 775945 ± 1556121 and 521285 ± 868041 for the CD4+ <200, CD4+ 200-499, and CD4+ ≥ 500 groups, respectively ($P=0.012$), (Table-4). This upward trend of viral load with lower CD4+ counts was

statistically significant.

Table-4: Comparison CD4+ T cell Counts with Viral Loads in HIV.

Parameter	CD4++ < 200/ μ l (n =18)	CD4++ 200-499/ μ l (n =38)	CD4++ \geq 500/ μ l (n =50)	P-value
Viral Load (copies/ml) (mean \pm SD)	19286695 \pm 58395959	775945 \pm 1556121	521285 \pm 868041	0.012

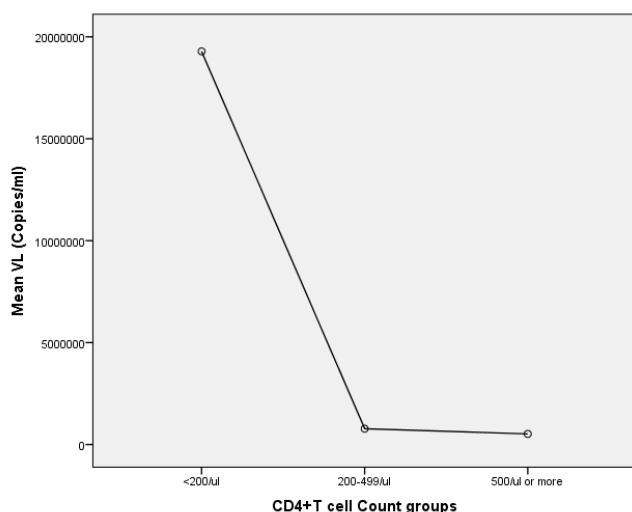


Fig. 2: Relationship between CD4+ + T cell counts and viral load.

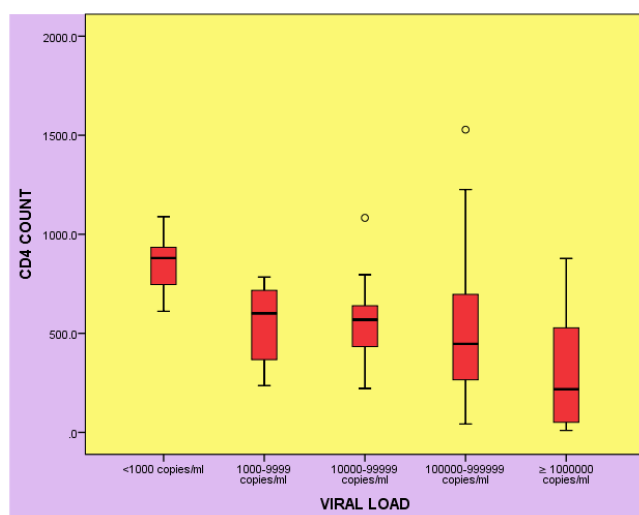


Fig. 3: Box plot shows comparison of CD4+ count with viral load. Median of CD4+ count decreasing with increasing viral load and vice versa (reciprocal relation-ship).

The mean viral load copies/ml for different CD4+ count groups are plotted in the graph. Inverse relationship was observed; with increasing CD4+ counts, viral load was found to be decreasing (Fig. 2).

DISCUSSION

It is important for all people with HIV to take regular blood tests. The two most important blood tests are CD4+ counts and viral loads and viral load.

We reported CD4+ counts and viral loads in newly diagnosed HIV patients from Punjab AIDS Control Program after observing their demographic features. It was observed in this study that among different age groups, maximum number of patients (54.7%) were below 30 years of age. Siddeswari and colleagues also calculated the frequency of 54% which fall in the age group between 20 – 40 years.⁸

Present study includes 83.7% males, 17.16% females and 6.6% transgender. Siddeswari also showed more percentage of males but frequency of females was also around 41%.⁸

Usually for people don't have HIV infection at CD4+ count between 500 and 1200/ μ l, HIV treatment isn't usually recommended at CD4+ count above 350/ μ l, HIV treatment is recommended at CD4+ count below 350/ μ l and below 200 there is a higher risk of illnesses and infections, so HIV treatment is recommended.⁹ Therefore, two important parameters i.e., viral load and CD4+T cell count are used for initiation, monitoring of therapy and to assess the progression of HIV infection.¹⁰

Although viral load predicts the rate of decrease in CD4++ lymphocyte count leading to AIDS and death, but the prognosis of HIV-infected persons is more accurately predicted by the measurement of plasma HIV-1 RNA and CD4+ lymphocytes, both.¹⁰

Mean of viral load was increased with lowering CD4+ counts and shows significant difference ($P=0.012$), that indicates progression of the disease also depend upon increasing viral loads. In a study conducted in Nepal in 2016, various categories of CD4+ T cell levels and viral load were compared. A significant association was found between viral load and CD4+ T cell count ($P=0.028$) with reciprocal relationship between them.¹¹ The findings in this study are consistent with the current study. Another study in accordance with the present study was conducted in India showing viral load inversely proportional to CD4+ cell count.¹²

Another study reveals that the increasing median viral load of males declines CD4+ count while

increasing the rate of disease progression and relative infectivity.¹³

A study conducted in South Africa in 2013 showed that most of the newly diagnosed patients of HIV showed low CD4+ count and higher viral load. It was suggested that consideration should be given to replacing CD4+ count with viral load for ART initiation.¹⁴

CONCLUSION

It was concluded that there was an inverse relationship between CD4+ T cell count and viral load. With increasing viral load CD4+ T cell count decreases. So viral load can be utilized as a screening tools to monitor HIV infection progression and severity.

LIMITATIONS OF STUDY

Limitations to this study are social desirability bias that could may have resulted in misclassification of participants as first-time testers and being ART-naïve. Moreover, as the study is cross-sectional, it does not reflect the dynamic nature of CD4+ counts and viral load over the period of time.

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AUTHOR'S CONTRIBUTION

MIJ: Substantial contributions to conception and design, acquisition of data and analysis and interpretation of data.

RN: Drafting the article, Substantial contributions to conception and design.

MN: Substantial contributions to conception and design, revising it critically for important intellectual content.

SH, SM & MG: Substantial contributions to conception and design, Analysis and interpretation of data.

RA & AA: Substantial contributions to conception and design, drafting the article.

CONFLICT OF INTEREST

None to declare.

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None to disclose

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